Unit 3-Technology Infrastructure for E-commerce

1. Internet: Technology Background

The Internet is a global network of computers that communicate with each other. It allows sharing information, websites, files, emails, and supports all e-commerce activities.

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2. Evolution of the Internet (1961 – Present)

- **1960s:** Concept of packet switching introduced.
- **1970s:** ARPANET created, connecting universities.
- **1980s:** TCP/IP protocol developed, forming the modern Internet.
- **1990s:** World Wide Web (WWW) invented, allowing websites and browsers.
- **2000s–Now:** High-speed internet, WiFi, mobile internet, cloud computing, and IoT.

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3. World Wide Web (WWW)

The WWW is a system of web pages connected through hyperlinks and accessed using the Internet.

Basic Idea of WWW

- Uses **web pages**, **links**, **browsers**, and **servers**.
- Works on standards like **HTML**, **HTTP**, and **URLs**.

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4. Essential Components of the Web

Tim Berners-Lee created the first web system using:

- **HTML** – structure of web pages
- **HTTP** – communication protocol
- **Web Server** – stores & delivers web pages
- **Browser** – displays web pages

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5. Hypertext & Hyperlink

- **Hypertext:** Text that contains links to other pages.
- **Hyperlink:** The clickable link that redirects to another webpage.

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6. URL (Uniform Resource Locator)

A URL is the address of a particular website or webpage.
Example: https://www.google.com

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7. Domain Names

Domain names replace IP addresses to make websites easy to remember.
Examples:

- .com
- .org
- .edu
- .gov
- .in

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8. HTML (HyperText Markup Language)

HTML is the basic language used to create web pages.

HTML Element

An element includes:

```
<tagname> content </tagname>
```

Examples:

- `<h1>` headings
- `<p>` paragraphs
- `<a>` links

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9. XML (eXtensible Markup Language)

XML stores and transports data.
It is used for data sharing between different systems in e-commerce.

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10. Web Servers

A web server:

- Stores web pages
- Uses HTTP
- Sends website content to browsers upon request

Web Server Software

Examples:

- Apache
- Nginx
- Microsoft IIS

Specialized Servers

- Email servers
- File servers
- Database servers
- Media servers

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11. Web Client

A web client is the user's device or software (like a browser) used to access websites.

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12. Web Browsers

Browsers display web pages and interpret HTML, CSS, JavaScript.

Examples:

- Google Chrome
- Mozilla Firefox
- Internet Explorer
- Safari
- Microsoft Edge

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13. Communication Tools

Skype

Used for:

- Voice calls
- Video calls
- Instant messaging

Video Conferencing

Allows virtual meetings with multiple participants.

Video Chatting

One-to-one live video interaction.

Telepresence

High-quality virtual meetings that make participants feel physically present.

14. Search Engines

Software that helps users find information on the Internet.

Examples: Google, Bing, Yahoo.

They work by:

- Crawling web pages
- Indexing content
- Ranking results based on relevance

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15. Downloadable Media

Digital files like music, videos, documents that can be downloaded to devices.

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16. Streaming Media

Videos or audio played online without downloading.

Examples: YouTube, Netflix, Spotify.

Podcast

Audio programs available on Internet streaming platforms.

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17. Web 1.0

- Early static web
- Read-only websites
- No interaction
- Users only viewed information

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18. Web 2.0 – The Social Web

- User-generated content
- Interaction and sharing
- Social media, blogs, forums, wikis

Examples

- Facebook
- YouTube
- Instagram

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19. Blogs

Online journals where individuals or companies publish content and share opinions.

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20. Wikis

Websites where users can collaboratively edit and update content (e.g., Wikipedia).

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21. Virtual Reality (VR)

A fully computer-generated 3D environment experienced using VR headsets.

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22. Augmented Reality (AR)

Adds digital elements into the real world using smartphone cameras.

Example: Instagram filters, Pokémon Go.

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23. Mixed Reality (MR)

Combination of AR + VR where virtual objects interact with real-world elements.

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24. Intelligent Digital Assistants

Software that responds to voice commands.

Examples:

- Siri
- Alexa

Used for:

- Reminders
- Searching information
- Smart home control

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25. Mobile Apps

Smartphone applications, widely used in e-commerce.

Types of Mobile Apps

1. **Native Apps** – built for specific OS (Android/iOS)
2. **Web Apps** – run on browsers
3. **Hybrid Apps** – mix of both

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26. Current Mobile App Trends

- **AI & Machine Learning**
- **AR & VR in apps**
- Cloud-based apps
- Mobile wallets
- Wearable technologies
- 5G enabled apps
- IoT integrations

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27. E-Commerce and Mobile Payments

Mobile payments allow users to pay through:

- UPI
- Wallets (Paytm, PhonePe)
- Cards
- Net banking

These payments drive online shopping.

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28. Privacy and Data Protection

Ensures:

- User data is protected
- Secure handling of personal information
- Prevention of unauthorized access

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29. Mobile App Security Considerations

Important practices:

- Strong authentication
- Data encryption
- Secure coding
- Regular updates
- Protecting APIs
- Safe communication channels
- User permission control

UNIT 4-Building An E-commerce Presence

1. A Systematic Approach to Build an E-Commerce Presence

When creating an e-commerce business, you must answer important questions and follow structured steps. These include:

- What is your **vision**?
- What is your **business and revenue model**?
- Who is your **target audience**?
- What is the **market like**?
- Where will your **content** come from?
- Conduct a **SWOT analysis**
- Make an **e-commerce presence map**
- Create a **timeline**
- Prepare a **budget**

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2. Visioning Process (What's the Idea?)

Before building the site, you need a clear **vision**.

A vision includes:

- Mission/purpose
- Target customers
- Market characteristics

- Strategy and SWOT
- Marketing plan
- Timeline and budget

Examples of famous visions:

- Amazon → “largest marketplace on earth”
- Facebook → “connect the world”
- Google → “organize world information”

A clear, short mission drives your whole e-commerce plan.

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3. Business & Revenue Model

You need a basic idea of:

- **Business Model**
    - Portal
    - E-tailer
    - Content provider
    - Transaction broker
    - Market creator
    - Community provider
    - Service provider

- **Revenue Model**
    - Advertising
    - Subscription
    - Transaction fees
    - Sales
    - Affiliate revenue

Companies can use multiple models.
Example:
Financial Times → subscriptions + ads + selling photographs
Amazon → orders + Prime + groceries + ads

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4. Target Audience

Your success depends on clearly identifying:

- Demographics (age, income, gender, location)
- Lifestyle/behavior
- Online vs offline buying habits
- Device & digital usage
- Social media habits
- Buyer personas

Example: Harley Davidson attracts customers from **age 34–65** across income groups.

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5. Characterizing the Marketplace

Before entering a market, study:

Market conditions

- Is it **growing or declining**?
- Are competitors strong or weak?
- Is the market **shifting online**?
- What platforms do customers use (web or mobile)?

Social media activity

- What percent of users are active on social platforms?
- How many likes/followers do competitors have?

Competitors

- Market share
- Online presence
- Customer reviews
- Unique monthly visitors (UMV)

Market structure

- **Direct competitors** → similar products (e.g., Apple vs Samsung)
- **Suppliers** → Foxconn, TSMC for Apple
- **Substitute products** → feature phones vs smartphones

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6. Content Strategy (Where's the Content Coming From?)

Content is the **heart** of a website.

Types of content:

- **Static content:** permanent (product descriptions)
- **Dynamic content:** frequently updated (news, prices)
- **User-generated content:** reviews, blogs, photos
- **External content:** embedded YouTube videos, Pinterest images

Good content increases traffic, sales, and SEO ranking.

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7. SWOT Analysis

Use SWOT to plan:

- **Strengths:** what you do well
- **Weaknesses:** areas to improve
- **Opportunities:** growth possibilities
- **Threats:** competition, legal issues

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8. E-Commerce Presence Map

Shows all the ways you will reach customers:

Components:

- **Website/App** (main storefront)
- **Social media** (Facebook, Instagram, Twitter)
- **Email marketing**
- **Offline media** (TV, print, radio)

For each platform, plan:

- Search engine marketing
- Display advertisements
- Affiliate programs
- Social media marketing
- Content creation

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9. Timeline (Milestones)

Break the project into phases (usually 6 phases) such as:

1. Planning
2. Designing
3. Developing
4. Testing

5. Deployment
6. Review & improvement

A typical timeline covers **one year** for a startup.

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10. Budgeting

Website cost depends on:

- Company size
- Features
- Hosting
- Maintenance
- Mobile app costs

Long-term costs include:

- Upgrades
- System maintenance
- Content updates
- Mobile versions

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11. Building an E-Commerce Presence: A Systematic Approach

Two major challenges:

1. **Understanding business objectives**
2. **Choosing the right technology**

You must plan in areas such as:

- Business goals
- Design decisions
- Technology selection
- Infrastructure

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12. Systems Development Life Cycle (SDLC)

A step-by-step method to build e-commerce systems:

1. System Analysis / Planning

Includes:

- Business objectives
- Required system functionalities
- Information requirements

Example business objectives:

- Display products

- Process orders
- Capture customer details
- Provide customer support

2. System Design

Two parts:

- **Logical Design:**
    - Data flow
    - Functions
    - Database structure
    - Security and backup
- **Physical Design:**
    - Specific servers
    - Software tools
    - Network requirements
    - Security systems

3. Building the System

Options:

- Build in-house
- Outsource
- Use templates or platforms
- Use CMS (like WordPress)

Tools:

- **WordPress** (cheap, easy, CMS-based)
- **Themes, widgets, plugins** (ex: WooCommerce)
- **Alternatives:** Wix, Shopify, Weebly, GoDaddy, Squarespace
- **Advanced tools:** Adobe Dreamweaver, Visual Studio
- **Enterprise Platforms:** HCL Commerce, Sitecore Commerce

DIY Pros & Cons

Pros: control, customization
Cons: costly, difficult, slow, quality risk

4. Testing

Important types:

- **Unit testing** – individual modules
- **System testing** – full site
- **Acceptance testing** – tested by managers

A/B Testing

Comparing two versions of a webpage:

Types:

- Template tests
- New concept tests
- Funnel tests (checkout steps)
- Multivariate tests (multiple elements)

Improve Page Performance

Methods:

- Efficient coding
- Server segregation
- Using multiple servers
- Content Delivery Networks (CDNs) → e.g., Akamai
- Increasing bandwidth

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13. Choosing Software

Website Architecture

1. **Single tier** – simple old websites
2. **Two tier** – web server + database
3. **Multi tier** – web server + application server + database
    - Best for e-commerce

Web Application Servers

Handle:

- User input
- Order processing
- Personalization
- Credit card processing

Web Server Software

Examples:

- **Apache** – most popular, open-source, stable
- **Microsoft IIS** – Windows-based, easy integration

Site Management Tools

Help with:

- Monitoring site performance
- Fixing broken links
- Tracking user behavior
- Checking errors

Dynamic Page Generation

Uses:

- HTML, CSS, JavaScript
- JSP
- Node.js
- ASP.NET

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14. Choosing Hardware

Hardware must support expected website traffic.

Demand Side Factors

- Number of users
- Type of content

- Searches
- Checkout activity
- Security
- Inventory size
- Peak load
- Bandwidth

Supply Side (Scaling the Hardware)

Three scaling approaches:

1. Vertical Scaling

Add more power to one server.

- Costly
- Single point of failure

2. Horizontal Scaling

Add more servers.

- Load balancing
- Cheaper
- More reliable

3. Improve Processing Architecture

- Add RAM
- Use separate servers for database, media, logic
- Reduce I/O bottlenecks

UNIT 5-E commerce security and payment system

1. The E-Commerce Security Environment

Introduction to Cybercrime

- Internet helps both good users and criminals.
- Criminals use the internet for theft, fraud, hacking, and illegal activities.
- Cybercrime is profitable and low-risk due to anonymity.
- In India, cyber fraud losses crossed **₹1.7 billion in 2024**.

Cost of Cybercrime

- Includes direct losses + recovery cost + security cost + reputational damage.
- Hard to measure exact losses because many victims don't report.

Types of Cyberattacks

Common threats include:

- **Botnets**
- **DDoS attacks**
- **Trojans**
- **Phishing**
- **Ransomware**
- **Data theft**
- **Identity fraud**

- **Credit card fraud**
- **Spyware**

These threats keep evolving.

Online Credit Card Fraud

- Criminals steal lakhs of card details.
- Stolen data is sold on the **dark web** for money.

Underground Economy Marketplace

Examples of stolen data prices (rough idea):

- Stolen credit card = few dollars
- Bank logins, identity information, hacked accounts — sold in underground markets.

Security in E-Commerce

E-commerce security needs:

- Technology (firewalls, encryption)
- Policies and procedures
- Industry standards
- Government laws

Both customers and merchants face risks:

Consumer risks

- Fraud
- Item not delivered
- Stolen card information

Merchant risks

- Fraudulent payments
- Chargebacks
- Non-payment

Complex Risk Reduction

Security is a mix of:

- Technology
- Policies
- Laws
- Training

Goal → bring criminals to justice and protect users.

Multilayered Security

“Defense in depth” → multiple layers of protection (Figure 5.1).

Security Technologies

- Encryption
- Firewalls
- Intrusion detection
- Anti-virus
- Secure payment gateways

Organizational Security Policies

- Rules for employees
- Handling customer data
- Safe internet practices
- Strong passwords, access control

Legal & Industry Standards

- Cyber laws
- Payment industry rules
- Laws help investigate and punish cybercriminals

Security Is Not Absolute

- No system is 100% secure.
- Aim = reduce risks.

- Security level must match data value.

Weakest Link Problem

- A system is only as strong as its weakest point.
- Usually, human error is the biggest risk (e.g., weak passwords).

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2. Dimensions of E-Commerce Security (Six Dimensions)

✓ 1. Integrity

Data should not be changed without permission.
Example: preventing unauthorized edits in bank transfers.

✓ 2. Non-repudiation

Users cannot deny their actions (e.g., online orders).

✓ 3. Authenticity

Verifying identity.
Example: checking if the website is real (no spoofing).

✓ 4. Confidentiality

Only authorized people can access information.

✓ 5. Privacy

Users must control how their personal data is used.

✓ 6. Availability

Website must work properly and stay accessible even under attacks.

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3. Tensions in Security

Security vs Ease of Use

- Strong security → sometimes harder user experience
- Too much security → users leave the website

Public Safety vs Privacy

- Governments need access to information for investigation
- But too much surveillance reduces individual privacy

Balance is necessary.

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4. E-Commerce Payment Systems

Online Payment Systems

- Online payments crossed **$5 trillion in 2020**.
- Most common: **credit cards & debit cards**.

Alternative Payment Systems

- PayPal
- Amazon Pay
- WhatsApp Pay
- Facebook Pay
- Mobile wallets

Mobile wallets are the fastest growing method.

International Variations

Examples:

- Netherlands → iDEAL
- China → Alipay
- India → Paytm, PhonePe, Razorpay, Cashfree, PayU

Online Credit Card Transactions

- Called **CNP** (Card Not Present) transactions.
- Higher chances of disputes & chargebacks.

Payment Enablers

Help merchants accept payments:

- Authorize.net
- RBI, UPI, Digital India initiative (India)

PCI-DSS Compliance

A global security standard for handling card information.
Non-compliance → fines + security risks.

Limitations of Credit Cards

- Fraud
- High fees
- Not accessible for all
- Chargebacks

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5. Mobile Payment Systems

Types of Mobile Wallets

1. Universal Proximity Wallets

Used at multiple merchants:

- Google Pay
- Apple Pay
- Samsung Pay
- Paytm
- Mobikwik
- Freecharge

2. Branded Store Wallets

Used only at one merchant:

- Walmart Pay
- Starbucks App

- Tesco Pay

3. P2P Payment Apps

Person-to-person payments:

- PayPal
- Apple Pay
- Samsung Pay
- Venmo
- Square Cash

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6. Blockchain & Cryptocurrencies

Blockchain

- Decentralized
- Secure
- Transparent

Bitcoin

- Popular cryptocurrency
- Very volatile
- Latest value mentioned: **₹80,94,876.63 INR**

Altcoins

Other cryptocurrencies besides Bitcoin.

ICOs

- Startups raise money by offering crypto tokens
- Many legal issues and scams

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7. Electronic Payment Systems (Modes)

1. Credit Card

- Bank pays on behalf of customer
- Customer repays later
- Actors: cardholder, merchant, issuer, acquirer, card network

2. Debit Card

- Money deducted instantly
- Customer must have balance

3. Smart Card

Looks like a credit card but includes a chip.

Types:

- Relationship-based smart cards
- Electronic purses (e-wallets)

4. E-Money

Money transferred digitally without cash.
Examples: e-cash, online wallet transfers.

5. Electronic Fund Transfer (EFT)

Transfer between bank accounts using:

- ATM
- Internet banking
- ACH (Automated Clearing House)

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8. Smart Cards in Detail

Contact Smart Cards

- Must be inserted into a card reader
- Powered through metallic contact pads

Contactless Smart Cards

- Use **RF technology**
- No physical contact required
  Examples:
- London Oyster
- Hong Kong Octopus
- Tokyo Suica & Pasmo

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9. Credit Card Payment Process (Steps)

1. Customer gets a credit card from bank.
2. Customer gives card details to merchant.
3. Merchant asks card brand company for approval.
4. Card brand authenticates & approves.
5. Merchant submits sales slip to acquirer bank.
6. Acquirer asks card brand company to settle.
7. Card brand takes amount from issuer bank.

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10. Roles in Credit Card Processing

Cardholder

Customer using the card.

Merchant

Business accepting card payments.

Acquiring Bank

Merchant's bank → processes payments

Issuing Bank

Customer's bank → pays merchant's bank

Card Associations

Visa / MasterCard

- Maintain network

- Set rules
- Set interchange fees

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11. Third-Party Credit Card Processors (OTTP)

Steps:

1. Buyer registers → gets account number
2. Buyer requests purchase
3. Seller sends account details to OTTP
4. OTTP verifies balance
5. Buyer confirms
6. Seller gives access to product
7. OTTP stores transaction until confirmation

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12. Designing Electronic Payment Systems

Factors to consider:

- Privacy
- Security
- Easy interface
- Database integration

- Pricing
- Legal standards
- Brokers for dispute settlement

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13. Risks in Electronic Payment Systems

1. Fraud or Mistakes

Need automatic records for disputes.

2. Privacy Issues

All transactions are stored → customers fear privacy loss.

3. Credit Risk

One bank failure can affect many banks → central bank must manage.